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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
VOLKER HENNIGE, ET AL.	: EXAMINER: RHEE, J. J.
SERIAL NO: 10/524,143	:
FILED: FEBRUARY 11, 2005	: GROUP ART UNIT: 1795
FOR: ELECTRIC SEPARATOR, PRODUCTION THEREOF AND USE IN LITHIUM HIGH POWER BATTERIES	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal of the Final Rejection dated April 14, 2008 of Claims 1-12 and 24-25. A Notice of Appeal is **submitted herewith**.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Creavis Gesellschaft fuer Tech. und Innovation, having an address at Paul-Baumann-Strasse 1, Marl, Germany, 45722.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignee are aware of no appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1-12 and 24-25 stand rejected and are herein appealed. Claims 13-23 stand withdrawn from consideration.

IV. STATUS OF THE AMENDMENTS

No amendment under 37 CFR 1.116 has been filed.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

A summary of the claimed subject matter, as claimed in independent Claim 1, is mapped out below, with reference to page and line numbers in the specification added in **[bold]** after each element.

A separator, **[5:6]** comprising a flexible nonwoven having a porous inorganic coating on and in said nonwoven, **[5:7-8]** and wherein the material of said nonwoven is selected from non-woven, nonelectroconductive polymeric fibers, **[5:8-10]** and wherein said nonwoven has a thickness of less than 30 μm, a porosity of more than 50% and a pore radius distribution, in which at least 50% of the pores have a pore radius from 75 to 150 μm. **[5:11-14]**

VI. GROUNDS OF REJECTION

Ground (A)

Claims 1-6, 9-12, and 24-25 stand rejected under 35 U.S.C. § 103(a) as unpatentable over US 6,495,292 (Yen) in view of JP 10-326607 (Omae et al).

Ground (B)

Claims 7-8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yen in view of Omae et al, and further in view of US 5,389,471 (Kung).

Ground (C)

Claims 1-12 and 24-25 stand rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-12 of copending Application No. 10/504,144 (copending application) in view of Omae et al.

VII. ARGUMENT

Ground (A)

Claims 1-6, 9-12, and 24-25 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yen in view of Omae et al. The rejection is untenable and should not be sustained.

As recited in Claim 1, an embodiment of the present invention is a separator, comprising a flexible nonwoven having a porous inorganic coating on and in said nonwoven, and wherein the material of said nonwoven is selected from non-woven, nonelectroconductive polymeric fibers, and wherein said nonwoven has a thickness of less than 30 μm, a porosity of more than 50% and a pore radius distribution, in which at least 50% of the pores have a pore radius from 75 to 150 μm.

Yen discloses a nonwoven battery separator which comprises a nonwoven, the nonwoven formed from a plurality of fibers and at least one high solubility parameter polymer, which polymer forms an encapsulation sheath around the fibers, which encapsulation sheath optionally has pores of about one micron or less and the separator has a surface pore size of at least five microns (column 1, lines 61-67). Yen discloses further that inorganic fillers can be added as part of the encapsulation sheath to improve the wettability of the nonwoven, in a particularly preferable range of between 0 and 50% by weight (column 2, lines 48-56). The encapsulation sheath around the fiber has a thickness of less than five

microns (column 3, lines 54-55), and the separator has a thickness of 1 to 50 mils (column 3, line 67), which is equivalent to 25-1250 microns.

The Examiner finds that Yen fails to disclose pore radius distributions in which at least 50% of the pores have a pore radius of from 75 to 150 μm. The Examiner thus relies on Omae et al. Omae et al discloses a battery separator based on a sea-island type composite fiber formed from a polyamide resin-based sea component and a polypropylene-based island component, which composite fiber is mixed with olefin series fibers as a binder so as to form a hybrid fiber, and a cloth web thus obtained is subjected to a water stream entangling process, followed by a sulfonating process, resulting in a battery separator whose maximum pore diameter ranges between 25 and 150 μm (English Abstract).

Finding that Omae et al discloses a nonwoven separator with a pore radius of 75 μm, relying on paragraph [0006] therein (which discloses 25-150 μm, not 75 μm), the Examiner holds that it would have been obvious to one of ordinary skill in the art to employ such a pore radius in the separator of Yen, in order to obtain excellent solution retention and absorbency, relying on paragraph [0004] of Omae et al.

In reply, it is not clear why one skilled in the art would have combined Yen and Omae et al, but even if combined, the result would not be the presently claimed invention. The present invention requires, *inter alia*, that the inorganic coating be porous. Yen does not disclose a porous inorganic coating. Rather, Yen discloses an encapsulation sheath of at least one high solubility parameter polymer, which is optionally porous and which optionally contains an inorganic filler, but the encapsulation sheath cannot be characterized as inorganic. In addition, the Examiner unjustifiably assumes that the excellent solution retention and absorbency disclosed by Omae et al is due to the disclosed maximum pore diameter range therein of between 25 and 150 μm, as opposed to all the other characteristics of their battery separator, as discussed above. In addition, while such a maximum pore diameter range is

beneficial for Omae et al, it is not clear that one of ordinary skill in the art would extrapolate such a pore diameter range to a separator as disclosed by Yen, which does not resemble that of Omae et al.

Thus, a *prima facie* case of obviousness has not been made out. Nevertheless, Applicants have described comparative data in the specification that is probative of non-obviousness, as now discussed.

(Comparative) Example 1 describes a so-called S450PET separator, having an average pore size of 450 nm, a thickness of about 50 μm, and a porosity of about 47% ([0089]-[0091]). Example 3 describes a so-called S850PET separator, having an average pore size of 865 nm, a thickness of 30 μm, and a porosity of about 53% ([0095]-[0097]). (Comparative) Example 4, using the S450PET separator ([0098]-[0099]), and Example 5, using the S850PET separator ([0100]-[0102]), were compared with regard to charging and discharging when used in a lithium ion battery. Using the comparative S450PET separator, on discharging the battery at C (about 3 mA/cm^2), it is found that at these high currents it is impossible to discharge the entire capacity, which is attributable to the internal resistance which is still too high ([0099]). However, with regard to the inventive S850PET separator, on discharging the battery at C (about 3 mA/cm^2), it was found that virtually the entire capacity of the battery can be discharged at these high currents, which is attributable to higher porosity, lower thickness, larger pore size and hence lower internal resistance compared with that of (Comparative) Example 4 ([0102]).

(Comparative) Example 4, although outside the terms of the present claims, is closer than any of the prior art relied on by the Examiner. Compare *Ex parte Humber*, 217 USPQ 265 (Bd. Pat. App. & Inter. 1981) (comparative data showing the claimed chlorine-containing compounds to be unexpected over various (non-prior art) chlorine-containing isomers was

accepted as more probative over prior art, drawn to non-chlorine containing analogs of the claimed compounds, asserted to be closest.)

In the Final Rejection, in response to Applicants' argument that Yen does not disclose a porous inorganic coating, the Examiner finds that Yen "teaches inorganic fillers that are added as part of the encapsulation sheath to improve the wettability of the nonwoven thus the inorganic fillers are considered the inorganic coating because the inorganic fillers is on and in the nonwoven material as desired by applicant's claim 1."

In reply, that Yen's encapsulation sheath may optionally contain inorganic fillers does not make the encapsulation sheath inorganic since, as discussed above, the sheath must contain at least one high solubility parameter polymer. **No** inorganic polymers are disclosed or suggested.

In response to Applicants' argument that there is no suggestion to combine Yen and Omae et al, the Examiner cites *In re Fine* (citation omitted) and *In re Jones* (citation omitted)), and essentially repeats her previous conclusion of obviousness. Applicants do not disagree with the precedent of *Fine* and *Jones* herein but they are inapposite, for reasons above stated. In addition, the Examiner's response includes no response to Applicants' argument of unjustifiable assumption by the Examiner that the excellent solution retention and absorbency disclosed by Omae et al is due to their disclosed maximum pore diameter range, as opposed to all the other characteristics of their battery separator. Nor does the Examiner respond to Applicants' argument that while such a maximum pore diameter range is beneficial for Omae et al, it is not clear that one of ordinary skill in the art would extrapolate such a pore diameter range to a separator as disclosed by Yen, which does not resemble that of Omae et al. Nor does the Examiner respond to Applicants' argument regarding the comparative data herein.

Claim 9

Claim 9 is separately patentable. Yen does not disclose any porosity for his separator. The Examiner's citation to column 2, line 67 of Yen refers to the wet porosity of a cellophane material disclosed as an exemplary material for the encapsulation sheath therein, not the battery separator *per se*.

Claim 10

Claim 10 is separately patentable. The Examiner finds that the recited breaking strength is inherent in Yen. However, there is no basis for the Examiner finding such inherency, given the other differences, as discussed above, between the presently-claimed separator and that of Yen.

Claims 11 and 12

Claims 11 and 12 are separately patentable. The Examiner finds that the recited bendable limitation is inherent in Yen. However, there is no basis for the Examiner finding such inherency, given the other differences, as discussed above, between the presently-claimed separator and that of Yen.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

Ground (B)

Claims 7-8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Yen in view of Omae et al, and further in view of Kung. The rejection is untenable and should not be sustained.

The disclosures and deficiencies of Yen combined with Omae et al have been discussed above. Kung does not remedy these deficiencies.

The Examiner relies on Kung as disclosing oxide particles. However, the oxide particles in Kung are optional inorganic alkali resistant fillers (column 4, line 42ff) in a wettable battery separator for alkaline batteries comprising a porous sheet selected from the group consisting of microporous films, fabrics and synthetic papers, wherein the sheet is saturated with the resin containing one or more carboxyl groups which have been neutralized with a base so as to form a salt wherein the resin is present in an amount of from about 0.0001 to 3% by weight of the sheet (column 2, lines 23-31 and Claim 1). In effect, Kung does not remedy any of the above-discussed deficiencies in the combination of Yen and Omae et al. Indeed, the optional inorganic alkali resistant fillers of Kung are not part of a coating but are present in the separator *per se*. Thus, even if one of ordinary skill in the art were to combine Kung with Yen and Omae et al, the fillers of particle size disclosed by Kung would not be part of a coating.

In the Final Rejection, in response to Applicants' arguments regarding Kung, the Examiner cites the *Fine* and *Jones* cases again, and holds that it would be obvious to use a particle size within the range of presently-recited Claim 7 for the oxide particles of Yen "in order to provide a separator that is excellent in tensile strength, wicking properties, wettability and alkali resistance."

In reply, since the optional inorganic fillers, added to the encapsulation sheath, of Yen are present for a different purpose than the optional inorganic alkali resistant fillers of Kung, any rationale for combining these disparate disclosures is incongruous.

Claim 8

Claim 8 is separately patentable because none of the applied prior art discloses aluminum oxide particles of any average particle size, let alone that recited in the claim, adhered by an oxide of Zr or Si.

For all the above reasons, it is respectfully requested that this rejections be REVERSED.

Ground (C)

Claims 1-12 and 24-25 stand rejected on the ground of nonstatutory obviousness-type double patenting over Claims 1-12 of copending application in view of Omae et al. The rejection is untenable and should not be sustained.

While the Examiner speaks in terms of what the copending application discloses, the only relevant subject matter is the claims thereof. As admitted by the Examiner, the claims of the copending application recite nothing with regard to pore radius distributions in which at least 50% of the pores have a pore radius from 75 to 150 μm. Nor do the claims of the copending application require that their nonwoven thickness be less than 30 μm, since Claim 2 thereof recites a maximum thickness of 80 μm. The disclosures and deficiencies of Omae et al have been discussed above. Omae et al does not suggest that the particular maximum pore diameter range of between 25 and 150 μm disclosed therein would have any applicability in a battery separator such as that claimed herein, which has no resemblance to the battery separator of Omae et al.

In addition, DE 10208277, which is from the same patent family as the copending application, is described in the specification herein, as not especially suitable for use in lithium high power batteries, since these batteries have to give off large currents within a very

short time at virtually constant voltage, and these separators do not meet the performance requirements of such separators for lithium high power batteries because they are insufficiently porous and too thick and hence still insufficiently ion-conductive ([0011]).

In the Final Rejection, the Examiner in essence simply repeats the conclusion of obviousness stated in the first Office Action, but does not respond to the above arguments. Indeed, the Examiner discusses Yen in this response, although Yen is not applied in the rejection.

For all the above reasons, it is respectfully requested that this rejection be REVERSED.

VIII. CONCLUSION

For the above reasons, it is respectfully requested that the rejections be REVERSED.

Respectfully submitted,

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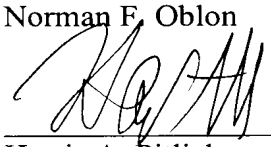

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CLAIMS APPENDIX

Claim 1. A separator, comprising a flexible nonwoven having a porous inorganic coating on and in said nonwoven, and wherein the material of said nonwoven is selected from non-woven, nonelectroconductive polymeric fibers, and wherein said nonwoven has a thickness of less than 30 μm, a porosity of more than 50% and a pore radius distribution, in which at least 50% of the pores have a pore radius from 75 to 150 μm.

Claim 2. The separator of claim 1, wherein said separator is less than 35 μm in thickness.

Claim 3. The separator of claim 1, wherein said polymeric fibers are selected from fibers of polyacrylonitrile, polyester, polyolefin or mixtures thereof.

Claim 4. The separator of claim 1, wherein said polymeric fibers are from 0.1 to 10 μm in diameter.

Claim 5. The separator of claim 1, wherein said flexible nonwoven has a base weight of less than 20 g/m^2.

Claim 6. The separator of claim 1, wherein said nonwoven is from 5 to 30 μm in thickness.

Claim 7. The separator of claim 1, wherein said porous inorganic coating, present on and in said nonwoven, comprises oxide particles of the elements Al, Si and/or Zr having an average particle size from 0.5 to 7 μm.

Claim 8. The separator of claim 1, wherein said porous inorganic coating, present on and in said nonwoven, comprises aluminum oxide particles having an average particle size from 1 to 4 μm, which are adhered by an oxide of the elements Zr or Si.

Claim 9. The separator of claim 1, wherein said separator is from 30 to 80% in porosity.

Claim 10. The separator of claim 1, wherein said separator has a breaking strength of more than 1 N/cm.

Claim 11. The separator of claim 1, wherein said separator is bendable around a radius down to 100 mm without damage.

Claim 12. The separator of claim 1, wherein said separator is bendable around a radius down to 1 mm without damage.

Claim 24. A method of producing a battery, comprising, inserting the separator as claimed in claim 1 into a battery cell.

Claim 25. A battery comprising the separator as claimed in claim 1, and one or more components.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.